Newman Consulting Group, LLC
HVAC Engineering & Business Consultants
Environmental Building Consultants
www.newmanconsulting.com

LEED® and Energy – How To Have a Healthier, Less Costly Building with Better Mech/Elec. Design

Environmental Impact of Buildings (U.S.)

- $259.7 Billion Industry in 2004
- Buildings (Non-Residential) – Approximately 5,000,000 in U.S.
  - > 30% of Total Energy Use
  - > 60 % of Electricity
  - 30% of Greenhouse Gas Emissions
  - 136 Million Tons of Construction & Demolition Waste
  - 12% Of Potable Water
- 5 Billion Gallons of Water - *to Flush Toilets!!*

Future Construction

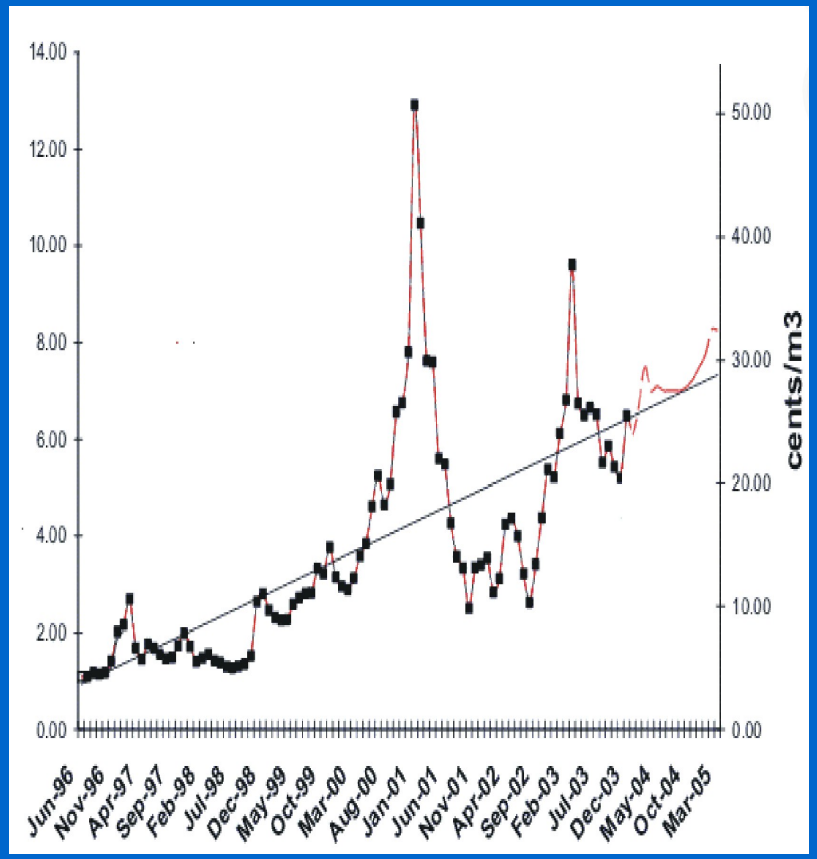
- By 2010 – 38 Million More Buildings (Residential & Non-Residential)

- Emissions Caused by Buildings (Non-Residential)
  - 49% of SO_2
  - 25% of NO
  - 10% of Particulate
  - 35% of CO_2
  - Up to 2.5# of Solid Waste / sq ft of Floor Space

DOE

Energy Trends…A Dismal Outlook

*Natural Gas Prices Up **270%** Over The Past



*Crude Oil Prices Up **250%** Over The Past

Energy Cost(s) – A Problem That Is Not Going Away

- U.S. Demand and Supply – Headed in Opposite Directions
- A Greater Problem – Escalating Demand in Other Countries
- By 2020 China Will Have Surpassed the U.S. and Europe *Combined* in Crude Oil Consumption!!

What is “Green Design” ?

- “Design and Construction Practices that Significantly Reduce or Eliminate the Negative Impact of Buildings on the Environment and Occupants in Five Broad Areas” – USGBC

  - Sustainable Site Planning
  - Safeguarding Water and Water Efficiency
  - Energy Efficiency and Renewable Energy
  - Conservation of Materials and Resources
  - Indoor Environmental Quality

What is a “Green” Building?

- Product of Intelligent, Integrated Design
- Surpasses Requirements of Standard Development Project
- Costs Less to Operate and Maintain

Why Green Buildings?

- Meet Needs of Today
  - Reduce Operating Costs
  - Save Energy
  - Improve Occupant Health and Comfort
  - Increase Occupant Productivity
  - Reduce Potential Liability
- Don’t Compromise Ability of Future Generations to Meet Their Needs
  - Environmental Responsibility
  - Optimize Resource Efficiency

Why LEED® ?

- Leadership in Energy and Environmental Design
  - Facilitate Positive Results for the Environment, Occupant Health and Financial Return (“Triple Bottom Line”)
  - Define “Green” by Providing a Standard for Measurement
  - Prevent “Greenwashing” (False or Exaggerated Claims)
- Whole-Building Approach
  - Collaborative, Integrated Design and Construction Process (Architects, Engineers, Owner and Building Team, Contractors)
  - Optimizes Environmental, Social and Economic Factors

LEED® Certification

LEED – NC (New Construction)	LEED – EB (Existing Building)
Certified: 26-32 Points	Certified: 32-39 Points
Silver: 33-38 Points	Silver: 40-47 Points
Gold: 39-51 Points	Gold: 48-63 Points
Platinum: 52+ Points (69 Possible, Including 4 for Innovative Design & 1 for LEED AP)	Platinum: 64+ Points (85 Possible, Including 4 for Innovative Design & 1 for LEED AP)

Points from Energy & Atmosphere (EA) and Environmental Quality (EQ)

LEED – NC

- EA: 17 Points
- EQ: 15 Points

Total: 32 Points = 50% of 64 Available (69-5)

+ Up to 4 Points for Innovation in Design

LEED – EB

- EA: 22 Points
- EQ: 22 Points

Total: 44 Points = 55% of 80 available (89-5)

+ Up to 4 Points for Innovation in Upgrades, Operation and Maintenance

Ideas to Think About

HVAC Systems - Largest Portion of Points in EA and EQ

What Happens if the HVAC System Functions Poorly?

Why Have Good-Looking Building with Poor HVAC → Poor IEQ, High Energy Bills

What Does “Green” Mean to HVAC?

- Green Is Not Always About Installing a High Efficiency Boiler or High Efficiency Chiller
- Green Is Avoiding the Need for That Boiler or Chiller (or at Least Significantly Downsizing Them)
- Green is Providing a High Performance Hybrid HVAC System
  - Energy Efficient Components
  - Design Strategies to Maximize Capabilities of Those Components

High Performance HVAC Benefits

- Innovative Engineering and Design
  - Improves System Performance
  - Reduces (Or Maintains) First Costs
  - Reduces Energy Costs (Saves Money)
  - Reduces Life Cycle Costs
  - Increases Life of Building Equipment
  - Reduces Maintenance Costs
  - Improves IAQ and IEQ
  - Minimizes Litigation Potential
  - Improves Productivity

Surpass Std. 90.1 & Save Money

- ASHRAE Advanced Energy Design Guide (AEDG) for Small Office Buildings (2004)
  - Building Envelope, Lighting, HVAC Equipment & Systems, Service Water Heating
  - New Systems
  - New Equipment
- Think Outside-the-Box
- Convince People Who Are Paying the Bill

Design Strategies - 1

- Dual Path Ventilation – Separation of Ventilation Air from Heating/Cooling Processes (Dedicated Outdoor Air System – DOAS)
- Evaporative Cooling and Humidification
- Energy Recovery – Reuse Energy Already Heated or Cooled
- Radiant Heating & Cooling

Design Strategies – 2

- Water Source Heat Pumps – Standard Closed Loop and Geothermal
- Underfloor Air Distribution (UFAD)
- Blow-Through Instead of Draw-Through Systems
- Optimal Temperature Supply Air
- Demand Control Ventilation
- Better Staging

Design Strategies - 3

- Low Pressure, High Effectiveness Filtration
- Thermal Storage
- Variable Speed Drives (VSD)
- Evaporatively Cooled Chillers, Condensing Units, Rooftop Packaged Units
- Wind Power

Design Strategies - 4

- Cogeneration
- Solar Collectors
- Noise and Vibration Control
- Control of “Plug Loads” (cf. EPA Energy Star®)
- Quality Assurance = Testing and Balancing, and Commissioning (of Entire Building)

Noise and Vibration Control

- A Necessary and Important Component of IEQ
- Do Not Set Rotating Machinery Above Occupied Spaces Where Possible
- Provide Proper Isolation for Application
- Make Sure Duct Design Does Not Add to Noise Level By Use of Abrupt Turns, Too Small Ductwork, etc.

“Plug Loads”

- Additional Energy Savings by Outfitting Offices with Energy Efficient Appliances and Office Equipment That Are Plugged into Electrical Outlets
- “Plug Loads” Can Be Up To 25% of Small Building’s Annual Energy Requirements
- Turn Off Equipment When Not In Use
- Buy Energy Star®-Rated Equipment

Electrical Loads

- Lower Electrical Loads = Smaller Starters, Wiring, Switchgear, etc. = Lower First Cost

- Something Designers Don’t Always Think About When Reducing Size of Mechanical Equipment

Lighting

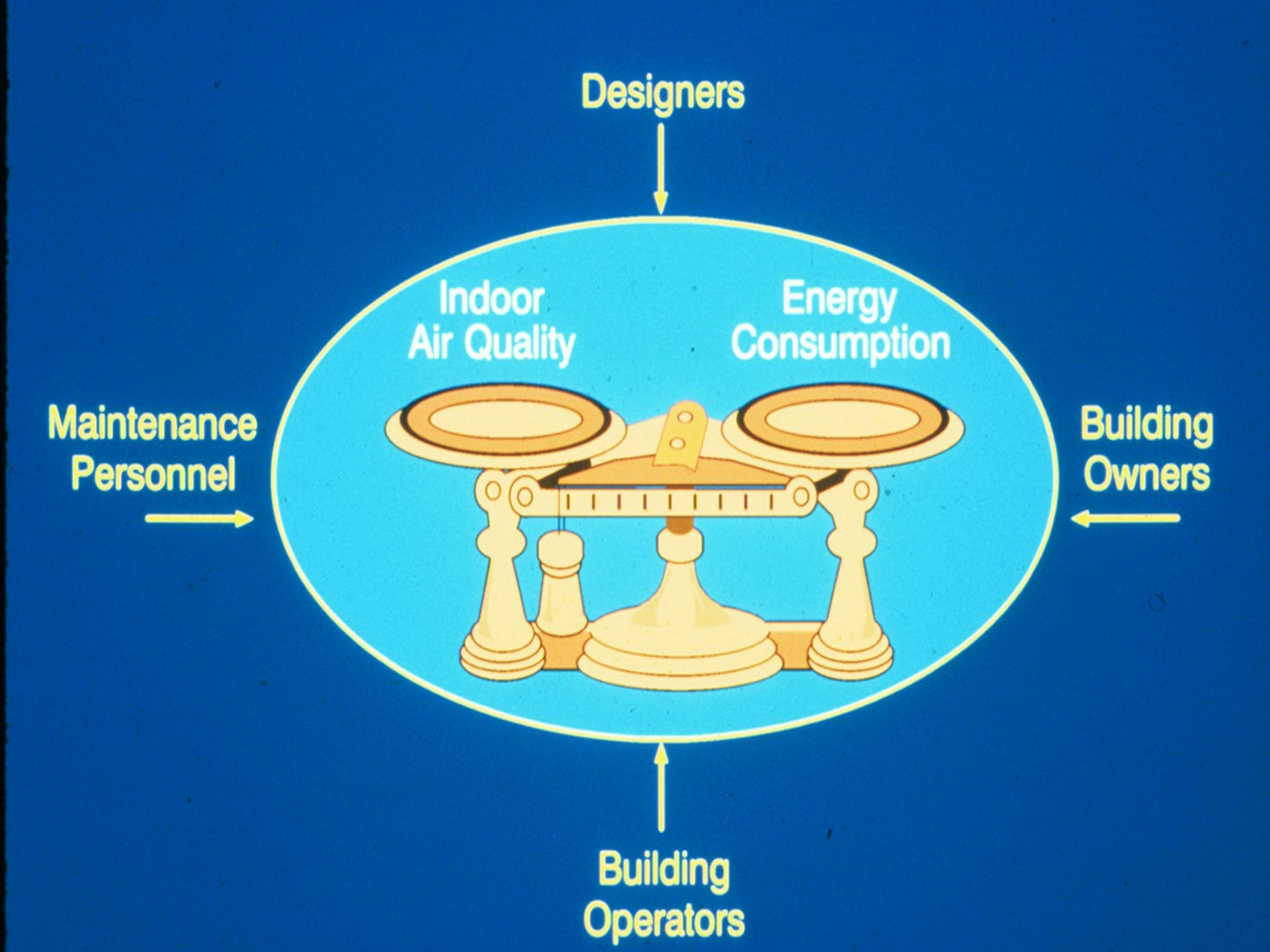
- Use Occupancy Sensors in Interior Spaces
- Use Photocells or Astronomical Time Switches on Exterior Lighting
- Turn Off Lighting When Not Required for Security Purposes
- Zone Lighting to Minimize Energy Waste

Quality Assurance

- Testing & Balancing – To Ensure *HVAC Systems* are Performing as Designed
- Commissioning – To Ensure ***Building*** is Performing as Designed

Operation & Maintenance

- Best Designs and Construction - Doomed to Failure Without Proper and Ongoing Maintenance
- Commissioning and Re-Commissioning
- Retro-Commissioning to Return to Original Design Concepts and Operation


Designers
Indoor
Air Quality
Energy
Consumption
Maintenance
Personnel
Building
Owners
Building
Operators

Guiding Principles

- Reduce Consumption to the Irreducible Minimum
- “Leave the World Better Than You Found It, Take No More Than You Need, Try Not To Harm Life or the Environment, Make Amends If You Do.”

  Paul Hawken, *The Ecology of Commerce*, 1993

References & Resources

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